CHEMICAL & ENGINEERING NEWS

C&EN

MARCH 23, 1992

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CHEMICAL & ENGINEERING NEWS

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MARCH 23, 1992

NEWS OF THE WEEK

- Senate hearing calls for immediate help by the U.S. for the science and technology establishment in the former Soviet Union. Page 4
- Federal appeals court upholds ruling that municipalities must share Superfund cost of cleaning up landfills containing hazardous wastes. Page 5
- U.S. has major problems in finding and appointing good scientific talent to top science and technology jobs in government, the National Research Council reports. Page 5
- Air Products head Dexter Baker will retire, effective May 1, when he will be succeeded by current president and chief operating officer, Harold Wagner. Page 5
- Two new findings in the properties and chemistry of buckminsterfullerene—unusual optical properties and C_{60} with a single iron atom trapped in its carbon cage—were disclosed last week. Page 6
- Dow Corning, the biggest maker of silicone gel breast implants, is exiting the business. Page 6

COVER: Photo by C&EN's James H. Krieger

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BUSINESS

Phillips 66 is back on track with its plastics business following the explosion that rocked its Houston complex in 1989, but faces problems of modest plastics demand, lingering lawsuits. Page 9

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Proposed new, tighter definition for scientific misconduct offered by Health & Human Services advisory panel would include concept of intent to deceive. Page 14

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Program that reads scanned molecular images and interprets these images into printed chemical structure diagrams is now available commercially, promises to be a boon to storage and access of such scientific information. Page 17

Fate of Australian science and technology is at crossroads and needs decisive efforts from the new coalition government to safeguard its future, according to president of Royal Australian Chemical Institute. Page 19

BOOKS

"International Handbook on Chemical Weapons Proliferation," though lacking information related to the Persian Gulf War, will serve as reliable reference for those who need to focus on the issues involved. Page 74

INSTRUMENTATION '92

Pittcon '92, the 43rd edition of the Pittsburgh Conference & Exposition on Analytical Chemistry & Applied Spectroscopy, included over 900 exhibitors and focused on the future direction of instrumental analysis. Page 22

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LETTERS

Academic future

It is certainly heartening to learn in the report, "America's Academic Future" (C&EN, March 2, page 17), of the importance that Presidential Young Investigators (PYIs) ascribe to undergraduate education. It, indeed, these people now carry that message back to their respective departments and institutions, and, more important, work actively to craft an environment that legitimizes faculty—including nontenured faculty—commitment to the nonresearch component of education, they will have performed an inestimable service to the advancement of science.

There is no inherent reason why the challenge cannot be met, and why the same intellectual energy that has served the U.S. research effort so magnificently cannot be as effective in addressing larger educational issues as well. The task will not be easy, because the culture that they describe is well embedded in academic departments, and because the needs and possible solutions in education are far more diverse than in the research arena. Unlike experimental or computational results, what works educationally in one setting may not work in another; adaptability, not replicability, is the keyword.

Here are some suggestions for making a change. First, doctoral education can emphasize to graduate students their responsibility as future teachers, even if their professional position's after degree completion do not take them into academic environments. Defining teaching as facilitating active learning by students, every chemist has both an opportunity and a responsibility to be a teacher. Accordingly, the notion that graduate students belong only in the laboratory needs drastically to be modified. Happily, there are instances at a few Ph.D.-granting institutions that show early signs of change in this attitude.

Second, it is gratifying to learn that PYIs are concerned about rewarding nonresearch activities, especially in the context of tenure and promotion. However, we still need to develop and agree upon the means to appraise the effectiveness of these efforts that incorporate principles of rigor analogous to those used in evaluating research. Otherwise, teaching is still likely to suffer characterization as a second-class activity. The argument that teaching (usually referring to traditional classroom teaching) cannot be evaluated, especially externally, is self-defeating. Difficult, yes; impossible, no. We just haven't figured out how to do it meaningfully. Taking advantage of what is known about learning, chemists can indeed unravel the enigma of evaluation.

Third, in addition to competitively reviewed and awarded external grant support for scholarly educational efforts, invitations to present seminars in academic departments on educational advances can contribute substantially to legitimizing and encouraging faculty members to commit at least part of their energies to education. Approbation by one's peers, of which invitations to speak are an example, is probably exceeded only by money as a stimulus for further engagement in a useful endeavor.

Fourth, because the criteria of scholarly research achievements for tenure and promotion are part of an almost universally accepted canon at institutions of higher learning, the opportunity exists for a disciplinary restructuring of that canon to include educational contributions. Within an institution, academic administrators can do this only to a highly limited extent, and individual departments might feel constrained from acting because of concern either about faculty dissension or that faculty members who object might seek to leave for other settings more to their liking. The collective practitioners of the discipline, however, can make a difference, because it is they who set the comprehensive professional criteria. Here is an opportunity, for example, for the American Chemical Society's Committee on Science to take the lead by organizing efforts to build educational accomplishments into the tenets that characterize professional achievements.

An effective faculty member embodies attributes of both a teacher and a scholar. That is why, in 1970, the Camille & Henry Dreyfus Foundation introduced its Teacher-Scholar Awards Program. The balance between research and nonresearch professional accomplishments, however, is a highly personal choice, and for any individual may change over time—especially as human productive lifetimes increase. As long as high levels of excellence are maintained, these variations should be not merely tolerated but encouraged, at a minimum with the support mechanisms available to those who want to change research directions. It is

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Phillips Rebuilds Plastics Business Following 1989 Texas Explosion

Problems confronting company, however, are moderate plastics demand, pending lawsuits, and scrutiny from OSHA

Susan J. Ainsworth, C&EN Houston

When an explosion and fire rocked Phillips 66's Pasadena, Tex., chemical complex in October 1989, it made no small impact on the U.S. plastics business. The blast crippled one of the largest polyethylene facilities in the world, shuttering roughly 18% of total U.S. capacity for high-density polyethylene (HDPE). The accident also brought Phillips' plastics business to a virtual standstill, because production facilities for polypropylene and K-Resin styrene-butadiene copolymers at Pasadena had to be idled for a short time.

But now, Phillips 66, which is based in Bartlesville, Okla., says it has fully recovered from the blast. Bob Benz, vice president for plastic resins, says, "We've been two and a half years getting over the accident, and we think we're now back on track."

Over the past two years, the company has done more than rebuild its HDPE production capacity. Phillips 66 also has done some soul searching, deciding what operations really fit its long-term strategy. It has invested in recycling, and tried to sell some of its plastics businesses.

Unfortunately for Phillips, the company is getting back on track at a time when demand for HDPE remains moderate at best. "There's just too much supply," says Mark House, vice president for polymers at Houston-based consultants DeWitt & Co. After the boom years of 1987 and 1988, too many companies jumped on the bandwagon and added plants.

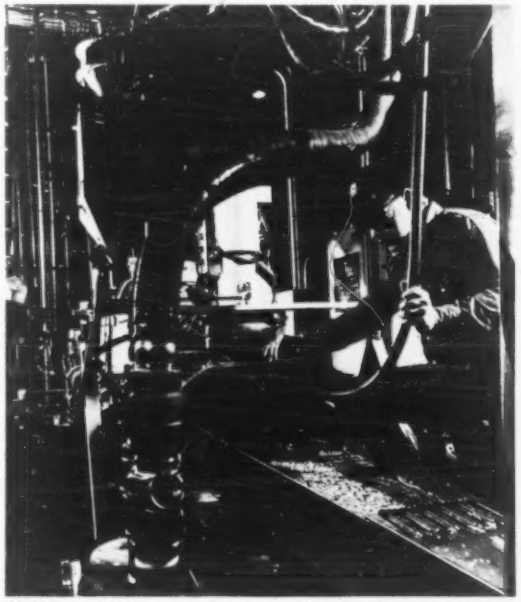
Although HDPE plant operating rates hovered around 98% in 1988, plants were running at only 88% of capacity in 1991. What's more, DeWitt anticipates rates to drop to between 80 and 82% this year and to "stay in that range for the next three years." House says he "fully expects to see some HDPE producers opt to sell their businesses or to shut down some of the higher cost production units in this period of rationalization." That would mean that newer, lower cost HDPE units would gain market share, which could be good news for Phillips.

Holding on to both market share and its customers was something that consultants said would be a chore for Phillips at the time of the explosion, but Phillips says it has fared well. The company was able to continue to satisfy its customers during the outage by purchasing plastics from its affiliate in Singapore to supply material under Phillips' name, says Benz. Those purchases have now stopped. Some in the company are amazed at the commitment from customers even after the time it took to rebuild the Pasadena facility—and during a recession.

Benz says Phillips will place 1.2 billion lb of polyethylene in the marketplace in 1992 with "less disruption than might be anticipated. The overcapacity in the industry is expected to be reduced through improved demand in the second quarter."

One saving grace for HDPE producers, including Phillips, is that total exports of their product from the U.S. broke a record in 1991, reaching 1.37 billion lb, representing 15% of 1991 production. That compares with 1990 HDPE exports of 921 million lb, or 11% of production that year, says House. He expects export growth to continue, but at a slower pace mainly because of the addition of capacity outside the U.S. Another plus for HDPE producers. "When times are tough, the packaging industry turns to HDPE because it is a cheaper alternative to paper, metal, and glass," says House. Still HDPE demand in the U.S. dropped roughly 1% in 1991, he adds. "While HDPE is fairly recession-resistant, demand did drop in response to the economy and changing packaging trends toward recycling and using less retail packaging."

With all the capital and time it took Phillips to rebuild its plastics business, it is surely keeping its fingers crossed that the plastics market will rebound soon. Rebuilding costs at the Pasadena site totaled $215 million last year, and Phillips has



Phillips technician checks recycled high-density polyethylene pellets as they enter dryer in final phase of production

allotted a further $185 million in 1992 capital funds for completing the restoration work. The company has brought its HDPE back on stream in 600 million-lb stages, with the first starting up last June and a second last October. Both plants are operating near capacity. When a third train comes on stream by the end of fourth-quarter 1992, Phillips will have surpassed the 1.3 billion-lb-per-year HDPE nameplate capacity at Pasadena at the time of the accident.

Phillips' 480 million-lb-per-year polypropylene unit and its 270 million-lb-per-year K-Resin facilities were not damaged by the blast, but were shut down for about one week because of the outage of utilities they shared with the HDPE units. More significantly, those plants were idled later for longer periods of time, but for reasons unrelated to the 1989 accident.

Phillips has had more on its mind over the past three years than restoring the Pasadena facility. Last September, Phillips put its polyphenylene sulfide business on the block, but so far it has not found a buyer that is willing to pay the firm price it is asking. And last July, Phillips put its Bartlesville-based advanced composite business up for sale. It decided to cease operation of that business by year-end 1991, even though a buyer was not found. John VanBuskirk, Philips 66's senior vice president for plastics, says, "While Axtel products are technically proven and competitively priced, the time required to make them commercially successful is too long compared with other attractive investments and opportunities the company wishes to pursue."

Phillips 66 also decided to halt progress with its developmental resin, polymethyl pentene, for which it has a patent. It plans to hang onto the technology for a couple of years until the plastics market comes back and then decide whether to build a commercial plant.

The company did some investing as well. Last month it completed upgrade work on its polypropylene plant and it continues to develop new K-Resin grades at its Bartlesville pilot plant. In late December, Phillips expanded into plastics recycling, opening an 18 million-lb-per-year plant in Tulsa, Okla., to recycle HDPE bottles. In September 1990 the company became a controlling partner in a 75%–25% venture called Phillips Plastic Recycling Partnership with Partek Corp., a privately owned recycling company based in Vancouver, Wash. The partnership's Tulsa recycling plant now has purchase commitments for over 75% of the recycled HDPE it will produce during 1992. "With everyone in recycling attempting to expand markets for material sales, we are very satisfied with our immediate acceptance," says Tim Taylor, managing director of the partnership.

Recycling is something that all plastics producers "are being forced into—there's no economic incentive at this point," says DeWitt's House. Their customers are demanding access to recycled plastics to satisfy consumers who are increasingly demanding packaging that is perceived as environmentally friendly, he adds.

Demand for postconsumer recycled resin is down right now. Recognizing that, Phillips built its plant so it later can be expanded to produce 40 million lb per year. Right now, in many cases, prices for postconsumer recycled resin is higher than for virgin resin, notes Dennis L. Rohlfing, the company's HDPE resins marketing manager. But that will change when one of two things happens: legislation is passed requiring increased use of postconsumer resins or the supply and demand balance of HDPE changes so that virgin HDPE prices will rise above that of recycle. "We can only guess which will happen first, but we probably won't see a change until 1994 or 1995." Still, he adds, "We have every reason to believe that this venture will be profitable over the long term."

Worker collects resin samples from Phillips' Bartlesville K-Resin copolymer pilot plant

To further support its plastics operations through integration, late last December Phillips started a new olefins unit at its Sweeny, Tex., complex. The unit has a rated capacity to produce 1.5 billion lb of ethylene per year and 600 million lb per year of propylene. About 80% of the olefin unit's ethylene production is committed under long-term contracts.

Although Phillips seems to have its plastics business in order, it still has its share of problems. The company has not yet settled all of its civil litigation from the 1989 explosion. In addition, the Occupational Safety & Health Administration continues to scrutinize the safety of Phillips' operations. Late last month, the agency proposed some minor fines for failure to record on-the-job injuries in a government-required log at Pasadena. And the plastics business is also not immune to the turmoil caused by the major layoffs and reorganization set into motion by parent Phillips Petroleum. "Most employees have viewed Phillips as a company that would take care of you for the long haul. My concern is that these measures will sap that morale," laments one plastics manager.

Phillips is clearly trying to overcome these obstacles. It is also anxious to get the word out that it is no longer on the sidelines in the plastics game. "We have not enjoyed being out and we are back without any doubt," says Benz. □

Phillips 66 again will be a top U.S. producer of HDPE

Millions of lb	Annual capacity 1989	1993[a]
Phillips 66	1550	1,800
Exxon Paxon	1300	1,800
Occidental Chemical	1270	1,710
Quantum Chemical	1750	1,690
Solvay Polymers	1160	1,440
Chevron Chemical	600	1,070
Union Carbide	650	900
Dow Chemical	525	600
Hoechst Celanese	350	425
Others	185	960
TOTAL	9340	12,395

[a] Estimated Source: [illegible]

Meeting targets Eastern Europe investment fears

Increased cooperation in environment, markets, and investment between Western European and Eastern European chemical industries will lead to sustainable economic development in Eastern Europe, according to speakers at a conference sponsored by the United Nations Economic Commission for Europe, held in Warsaw earlier this month. More than 170 delegates, representing some 22 countries, attended the meeting.

The meeting saw the launch of a new initiative by Brussels-based CEFIC, the European Chemical Industry Council, for assisting environmental cleanup in the Eastern European chemical industry. The program, called EASTT, for Environmental Advisory Service for Technology Transfer, will involve volunteer western chemical companies advising counterpart eastern enterprises, at the behest of government ministries working with CEFIC.

And given the theme "sustainable development," and the recognition of the enormous work needed to be done to clean up the environment in Eastern Europe, the meeting thrashed out some guidelines that will form part of a pan-European contribution to the United Nations Conference on Environment & Development, scheduled to be held in Rio de Janeiro in June.

Richard D. Freeman, chairman of the "economic outlook" working party of CEFIC, and chief economist at British chemicals giant ICI, helped put the discussion into perspective.

In 1989, the latest year for which comparable data are available, the West European chemical industry was the world's largest, and was more than double that in Eastern Europe: roughly $350 billion in sales versus about $160 billion, according to Freeman. By comparison, North America, counting the U.S. and Canada, was about $300 billion.

Production in Eastern Europe is skewed toward basic chemicals. However, while Western Europe has been reducing its reliance on basic chemicals, Eastern European industry has not been. In part, that has been because of the availability of feedstocks, Freeman suggests, but that continuity also illustrates the strategic differences between companies in Western Europe and historical planning priorities in Eastern Europe.

There was no question at the conference about the potential importance of the Eastern European industry. As Daniel Janssen, president of CEFIC, pointed out, Europe at present—the 12 countries of the European Community—is made up of 340 million people, and with the seven countries from the European Free Trade Association, another 40 million. When Central and Eastern European countries are included in a future Europe, that count will zoom to nearly 600 million people.

CEFIC is encouraging formation of national Central European chemical federations, with an eye to their eventual membership. Applications from three federations—from Turkey, Poland, and Hungary—will be considered at CEFIC's annual meeting in Vienna in June. There is even the possibility of formation of a CEFIC-like organization operating throughout the Commonwealth of Independent States, pulling together the chemical industries in the different countries formed in the breakup of the Soviet Union.

According to Janssen and Hugo Lever, director general of CEFIC, government-to-government aid can benefit the development of infrastructure in Central and Eastern Europe—transport, communications, banking, and so on. On the other hand, the EASTT program is one step that western companies can take to help provide aid that will have a multiplier effect—encouraging and stimulating trade, service, technology transfer, and, ultimately, direct capital investment.

Under the new program, if a plant in Central Europe needs a certain energy modification, for example, owners of the plant will talk to the country's ministry about the investment, to determine, among other things, if the plant or enterprise is in the strategic plan for the nation. If it is, then the ministry would make a request to CEFIC for assistance. CEFIC would turn to a Western European company making similar products, which would conduct an audit of the eastern plant, to find out precisely what revamping or improvement technology is needed. The company or enterprise could obtain the technology through a variety of funding mechanisms, with the assurance that it would be getting the most appropriate, up-to-date technology.

Finding the appropriate way to participate in what he terms the "unfolding social and economic progress of Eastern and Central Europe" is a perplexing problem, says David Williamson, president of Du Pont's European operations. Nonetheless, it is a question that is being tackled in a systematic way.

"Each year we make capital investments of about $5 billion, and since we operate in 60 countries, investments are made all around the world every day. We have developed criteria to help us prioritize potential investments." Among the company's criteria: The overall economics of the investment should be attractive; the company must feel welcome, both nationally and locally; good quality people should be available in adequate numbers; and there should be a sound infrastructure. Even more important, he adds, there must be a legal and government framework that limits risk and facilitates business: "Laws governing investment and property ownership must be clear—vague assurances on these points are not enough.

"Guarantees to encourage private investment are far more cost-effective than traditional foreign aid," he says. "Western governments are reluctant to make large foreign aid commitments at the expense of domestic programs," in the present economic climate. "Partnership with private companies is a far more attractive—and more effective—route. As a rule of thumb, every job created direct-

Basic chemicals dominate East European production

	% of world production	
	Western Europe	Eastern Europe
Ethylene	32%	11%
Methanol	9	28
Chlorine	29	15
Fertilizers	13	30
Agrochemicals[a]	27	7
Pharmaceuticals[a]	30	4
Polyvinyl chloride	29	11
Polyethylene, low density	29	11
Polyethylene, high density	26	6
Polyethylene, linear low density	13	1
Polypropylene	31	6

a Percentage of world demand. Source: CEFIC (European Chemical Industry Council)

ly by a foreign investor creates another three jobs to support the required infrastructure."

Government ministers from all the Central and Eastern European countries present at the meeting readily acknowledged the need to make changes encouraging foreign investment. It was clear, however, from presentations and from informal discussions in the corridors, that there is frequently a sizable gap in definition or attitude. What some authorities would call suitable action, corporate executives wouldn't. In light of their history, Central and Eastern European governments have made remarkably radical changes—changes demanded by potential investors. If western companies believe the changes don't go far enough, there is a danger these companies will feel betrayed.

Nonetheless, government authorities are trying to work to ease investment. For example, Thomas Kolaja, senior project manager in Poland's Ministry of Privatization, explained the Polish government's newly formulated approach to assisting privatization of its industry.

Last summer the country established 34 industrial sectors, and is working with western investment and banking advisers to prepare each sector for privatization. Among the factors to be considered, he points out, are upstream and downstream effects. They have to be kept in mind during privatization, in order to minimize disruptions in customer or supplier chains.

The ministry "seeks to clarify the market rules, so the private market and investors know what the rules are, and [to] make sure there is no confusion or conflict between agencies, for example," Kolaja says. "The only one who can really sell you a company is the Ministry of Privatization—we do the negotiations. Talk to us early in the process."

He concedes that judging environmental liability is a major problem. "In Central Europe, it is very difficult to give full, unlimited indemnity to companies. The budgets aren't ready to take the impact, but there is recognition of responsiblity. We can't give a blank check, but we'll fill it in for you, after we talk it through and both sides agree to the number."

Yet another means toward privatization has been launched in the Russian Republic, where a new stockholding corporation has been formed, called Roschimneft. All participating Russian chemical enterprises, and the government, have bought shares in the corporation, which will help promote marketing and distribution of Russian chemical products.

According to Vladimir Evsiukov, vice president, and Alexander Shashkov, principal specialist for international cooperation for Roschimneft, western investors are welcome—there are no proscriptions on their holding shares in the corporation, although none so far has taken a stake.

Patricia Layman

New Puerto Rican plant points ICI's direction

Sir Denys H. Henderson, chairman and chief executive officer of the U.K.'s largest chemical company, ICI, was in Puerto Rico earlier this month to dedicate a new $60 million bulk pharmaceutical plant that will make atenolol, the active ingredient in Tenormin, the company's beta-blocker, used for the treatment of high blood pressure and heart disease.

That the ICI chairman would dedicate a small plant outside the U.K. says much about ICI's direction for the future. No longer strongly tied to its home country and to commodity chemicals, the British company is investing more and more overseas and is beefing up production of its higher value-added products, especially pharmaceuticals.

This is borne out by the shift in just where ICI's money comes from. As late as 1985, 27% of the company's sales and about 42% of its operating profits came from specialty chemicals, including drugs, pesticides, explosives, and other higher value-added products. In 1991, these product areas accounted for almost 67% of the company's sales and more than 80% of its operating profits. And the percentage of sales coming from the U.K. has declined to a little more than 20% in 1991 from about 27% in 1985.

This is in line with two of the four points of ICI's latest strategy—to increase higher value-added earnings and reduce exposure to commodity chemicals and to improve the company's worldwide spread. The other two points are to ensure that adequate funds are made available for research and development and to be internationally cost competitive.

Since July 1990, when the company annnounced it would restructure its operations, ICI has taken a number of steps to reduce its "exposure to commodity chemicals." It has significantly downsized its fibers operations, exited nearly all of its fertilizer businesses, and sold its soda ash business, for example. In total, the company has disposed of about $3 billion in assets over the past year and a half and through disposal and reorganization in the past year alone has reduced employment about 15,000 or 11%. During 1991, it sold more than 20 businesses and closed more than 20 production facilities.

However, during 1990 and 1991, ICI increased its investment in pharmaceuticals, explosives, acrylics, automotive finishes, and chlorofluorocarbon replacements.

The emphasis on value-added products at the expense of commodity chemicals does leave in question the fate of two of ICI's older and bigger businesses—fibers and plastics. Fibers have already gone through a downsizing and there is rumor in Europe that ICI would like to be out of the plastics business, since, as Henderson says, in general the businesses the company keeps "must be global winners"—a hard task for these two operations. But, he told C&EN, "we don't comment on rumors, so this must remain an area of conjecture."

William Storck

Rafael Hernandez Colón, governor of Puerto Rico (left), and ICI's Henderson at plant dedication